

Use of a prefabricated fiber-reinforced composite resin framework to provide a provisional fixed partial denture over an integrating implant: A clinical report

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The development of fiber-reinforced composites offers new possibilities in minimally invasive tooth replacement approaches. This article describes the use of a prefabricated fiber-reinforced composite resin framework for the chairside fabrication of a provisional fixed partial denture over an integrating implant. The framework fabrication, theory, and a clinical scenario are illustrated. (J Prosthet Dent 2006;95:14-8.)

The placement of an implant in the anterior region when no immediate load will be applied during the bony integration phase produces the need for a provisional tooth replacement for the edentulous area during this period. This provisional tooth replacement should not impact the healing of the implant site or compromise the adjacent teeth but should maintain the position of the adjacent and opposing teeth. The need for both an esthetic and functional provisional prosthesis during the healing phase of osseointegration may create many challenges for the clinician. An acrylic resin removable partial denture approach may serve the purpose of maintaining the adjacent teeth in position but can create problems of inadequate stability and comfort for the patient, as well as unfavorable distribution of stress to the supporting tissues.^{1,2} Adhesively attached provisional fixed partial dentures (FPDs) can provide stability, function, and esthetics over integrating implants.^{3,4} In addition, the presence of proximal contact at an implant site has been shown to result in the maintenance and growth of the papilla tip approximately 5 mm apical to the contact.⁵ The same positive tissue reaction in the presence of a fixed prosthesis connector may be expected. Consequently, the use of a fixed provisional prosthesis immediately after implant placement may maximize the development of the papilla and result in substantially less time or no time needed for soft-tissue site development prior to making the final restoration impression.

The development of fiber-reinforced composite (FRC) resins has provided a class of materials with significantly increased strength when compared to particulate composite resins alone.^{6,7} This may be a significant factor in strengthening the critical connector area between the pontic and its attachment to the abutment teeth. The often-used alternative of attaching an artificial



Fig. 1. Facial view of lateral incisor area where implant was placed.

tooth adapted to fit the edentulous space has a number of problems that the FRC technique overcomes. The lack of chemical bond between the particulate composite resin and the acrylic resin of the artificial tooth, which can serve as a source of failure intraorally, is eliminated. The FRC provides increased strength in the critical connector area to decrease the potential for fracture. Also, most clinicians rely on 2 abutment teeth to retain an artificial tooth pontic, whereas a cantilever approach can be used with the FRC provisional prosthesis because of its strength characteristics. The use of resin-preimpregnated FRCs for various designs of direct chairside FPDs in situations not associated with integrating implants has been reported.⁷⁻¹³ This article describes the use of a prefabricated resin-preimpregnated FRC framework to provide a short-term provisional fixed partial prosthesis over a healing implant, using a cantilever approach.

CLINICAL REPORT

A 46-year-old white woman presented with an implant (ITI; Straumann USA, Inc, Waltham, Mass) placed in the right lateral incisor position (Fig. 1). The [F1-4/C]

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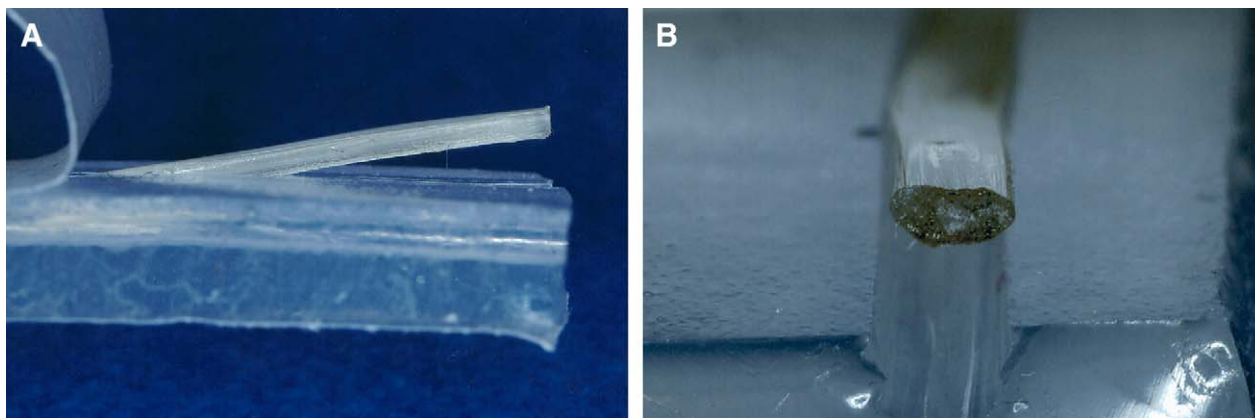


Fig. 2. **A**, Segment of everStick FRC being removed from packaging. **B**, View of segment of everStick from end. Glass fibers are bound in Bis-GMA/PMMA matrix, which is enveloped in PMMA wrap.



Fig. 3. Custom-made aluminum split mold used in fabrication of FRC frameworks.

patient desired a fixed rather than a removable provisional prosthesis to replace the missing lateral incisor during the 3-month integration period prior to loading the implant. An approach involving adhesive placement of an FRC framework to only the central incisor, with a composite resin veneer facing as a pontic to replace the missing lateral incisor, was presented to and accepted by the patient.

The FRC selected for use with this patient was a resin-preimpregnated, nonpolymerized, flexible design (everStick; Stick Tech Ltd, Turku, Finland). The manufacturer of this FRC purports that it is composed primarily of unidirectional glass fibers embedded in a matrix comprised primarily of Bis-GMA and is surrounded [F2-4/C] with a coat of PMMA (Fig. 2). This design allows the glass fibers to be flexible but not fray from within the matrix when adapted to a surface. The framework was composed of segments that were cut to form both a pontic support and a wing segment that was used to attach the framework to the abutment tooth. These parts

were assembled in a special split aluminum mold that was custom made by a machine shop to the authors' specifications. The lower half of the mold contained depressions to shape the pontic support segment and the wing section. The upper half of the mold was solid, with an opening corresponding to the size of the pontic depression in the lower half that, when seated on the lower half, permitted light polymerization of the pontic segments but shielded the wing from light polymerization (Fig. 3). This was critical, because the split-mold [F3-4/C] design allowed the wings to maintain both flexibility for adaptation to the abutment tooth surface and cross-linking ability between the polymers in the FRC and the luting resin. The pontic support segments were attached to the wing using a dual-polymerizing composite resin (Lute-It; Pentron Clinical Technologies, LLC, Wallingford, Conn) that was briefly exposed (4 seconds) to visible light polymerization (Spectra-Lite 990; Pentron Clinical Technologies, LLC). The completed assembly consisted of a prepolymerized pontic substructure and a nonpolymerized wing. The nonpolymerized wing was wrapped with aluminum foil (Western Plastics, Calhoun, Ga) to prevent ambient light from prematurely stiffening or polymerizing the FRC and the framework. The foil pouch was stored until it was needed for use intraorally.

Prefabricated frameworks may include either a cantilever or dual-wing design. The wing of the framework can be positioned on either the lingual or labial surface of the abutment tooth. This is determined by the amount of incisal clearance with the opposing teeth. The wing is then compressed with a gloved finger, which adapts and fans out the FRC, conforming it to the shape of the tooth surface. This spreading of the FRC increases the surface area of bonded attachment and thins the framework, leaving minimal bulk on the abutment tooth surface (Fig. 4). The wing is polymerized to the etched/ [F4-4/C] adhesive surface of the abutment tooth by a visible

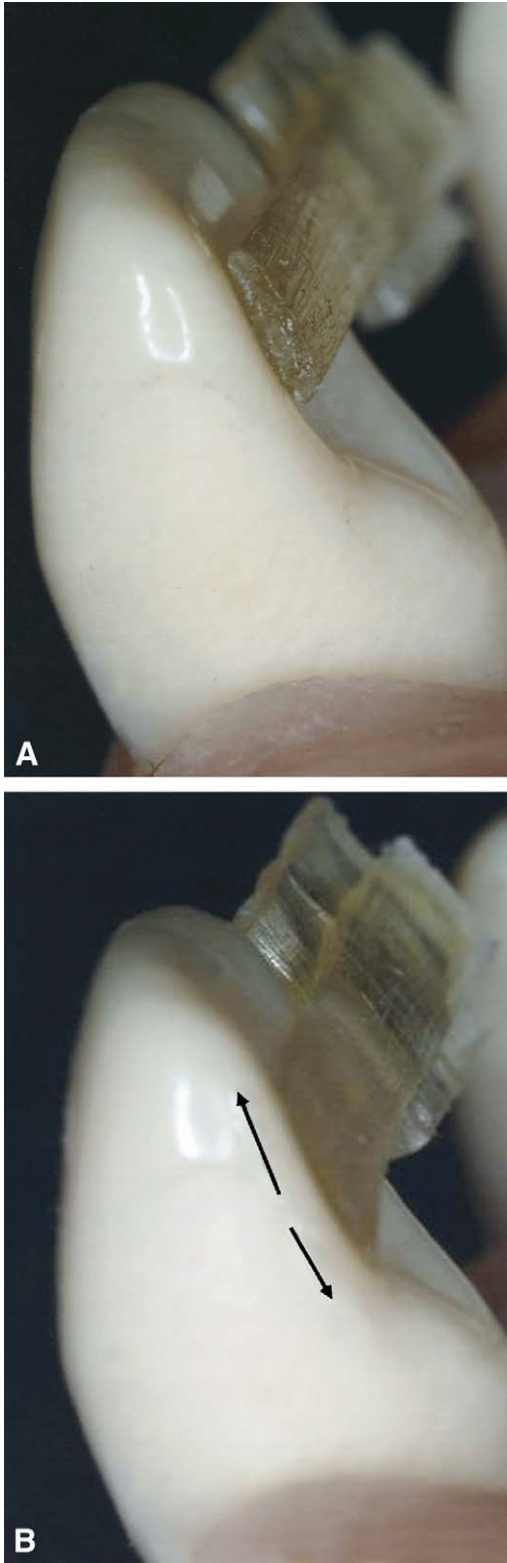


Fig. 4. **A**, Lateral view of FRC wing as initially placed on lingual surface prior to compression, approximately 1 mm thick at this point. **B**, Compressed wing demonstrating fanning of glass fibers and thinning of wing to approximately 0.1 mm. *Arrows* indicate direction of fanning or lateral spreading of FRC along lingual surface of tooth.

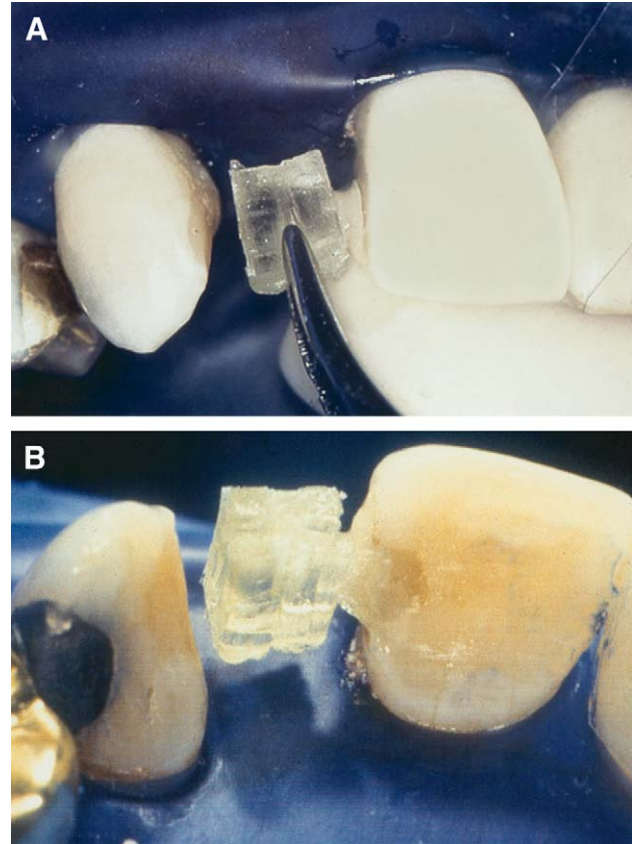


Fig. 5. **A**, FRC framework is placed by positioning pontic over implant with hemostat and compressing wing against palatal surface of central incisor. **B**, Appearance of FRC partial denture as first attached to lingual surface of central incisor.



Fig. 6. Building pontic using microhybrid particulate composite resin.

light-polymerizing unit using either a facial approach, through the abutment tooth for a lingual attachment, or a lingual approach for a facial attachment

For the scenario described, a rubber dam was placed and a cantilever FRC prefabricated framework was selected for placement on the palatal surface of the central

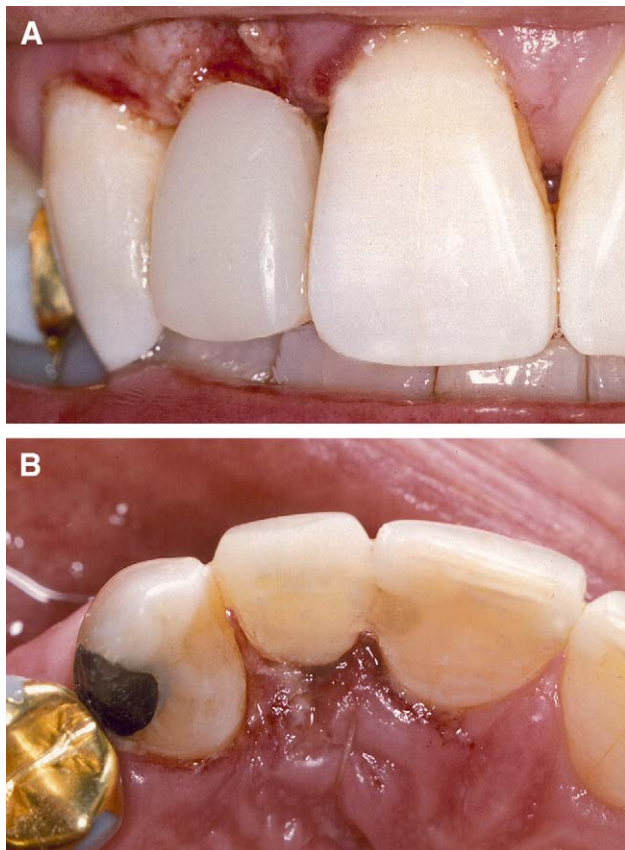


Fig. 7. **A**, Appearance of pontic, facial view. **B**, Palatal view of cantilever provisional fixed partial denture.

incisor. The framework was initially evaluated in the edentulous space by holding the polymerized pontic substructure with a curved hemostat to visualize the position of the pontic buccolingually and incisogingivally. The length of the wing was adjusted to fit the palatal surface of the central incisor. A Mylar strip (Patterson Dental Supply, Inc, St. Paul, Minn) was placed between the central incisors to limit the extent of spread of the adhesive and flowable resin. The palatal surface of the maxillary right central was etched with a phosphoric acid gel (Ivoclar Vivadent, Amherst, NY), and an adhesive (Excite; Ivoclar Vivadent) was placed. The foil was removed from the wing of the prefabricated FRC framework, and a thin layer of flowable particulate composite resin (Tetric Flow; Ivoclar Vivadent) was placed on the tooth side of the wing. The framework was positioned using a curved hemostat to hold the pontic substructure to the desired position within the edentulous space, and a gloved finger compressed the wing against the lingual surface of the abutment central (Fig. 5, A). The wing/flowable composite resin complex was polymerized from the facial direction for 60 seconds using a visible light-polymerizing unit (Astralis 10; Ivoclar Vivadent) at a power density of 800 mW/cm² to initially tack the complex to the tooth, then polymerized again



Fig. 8. FRC partial denture over healed implant 3 months after placement. Implant healing cap can be seen gingival to cervical area pontic.

from the lingual for an additional 40 seconds to complete the polymerization process. The placed and polymerized framework is shown in Figure 5, B. The wing had fanned and thinned out, as a result of the finger pressure, to adapt to the contour of the tooth. The pontic shape was finalized using particulate composite resin (Tetric Ceram; Ivoclar Vivadent) to create a natural and esthetic appearance (Fig. 6). The rubber dam acted as both a matrix to help shape the gingival side of the pontic and as a spacer to allow floss to pass underneath for oral hygiene. The finished cantilever FRC provisional FPD is shown in Figure 7.

The patient returned after 3 months to have the cantilever provisional FRC partial denture removed and the abutment and provisional crown placed on the implant (Fig. 8). The provisional FPD was intact and securely bonded to the central incisor. The tissue adjacent to the implant had healed and reshaped so that the healing cap of the implant could be seen on the facial surface. The FRC provisional partial denture was easily removed using a 12-bladed finishing bur (Brasseler USA, Savannah, Ga) by grinding away the winged segment of the partial denture with minimal loss of enamel on the lingual surface of the abutment tooth.

SUMMARY

The use of a prefabricated FRC framework to fabricate a chairside provisional partial denture provides the clinician with another option for managing esthetics and function after implant placement in the anterior region, where immediate loading is not used. This type of fixed tooth replacement provides the patient with a reliable alternative to the palate-supported removable prosthesis. The advantages of this approach include the efficiency of having a framework prefabricated,

the strength provided by the resin-preimpregnated FRC in supporting the particulate composite resin, both in the pontic and the connector area, and the ability to involve only 1 of the adjacent teeth around the implant for the attachment of the interim prosthesis. This permits ease of cleaning under the pontic and around the healing implant, and less time for placement and removal by the dentist.

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